DATA SYSTEMS, APPARATUSES AND/OR METHODS

BACKGROUND

[0001] Data storage and retrieval systems exist in many types and styles. There are, in fact, many such systems which are particularly useful for handling and storing data cartridges, such as optical disk or magnetic tape cartridges. Often these systems are used to store data cartridges in particular assigned or changeably selected and recorded locations or positions within the overall system, and to also retrieve desired cartridges on demand so that data may be written to or read therefrom. Some of these data storage and handling systems are often referred to as "juke box" data storage systems, particularly if they include robotics or other types of pick and place mechanisms or a rotisserie or rotating magazine or other sort of automated motion system for moving the cartridges from one location to another for loading any one or more cartridges for storage or use. These systems can each thus accommodate a large number of individual data cartridges.

[0002] A typical juke box data storage system may include one or more different types of cartridge related devices for receiving one or more of the various data cartridges. For example, one or more cartridge receiving storage racks or magazines are typical. Also often included is a cartridge read/write device such as a tape or disk drive which may read data from or write or record data to the media in/on the data cartridge. The cartridge storage racks or magazines may provide respective rows of storage locations for the data cartridges and are commonly arranged so that they form one or more horizontal rows. One or more cartridge read/write devices may then be located adjacent the cartridge rows. These types of storage racks (hereafter referred to as magazines) and the read/write devices are adapted to receive the data cartridges for storage or use and may thus be referred to generally as cartridge receiving devices. The data storage system may also be provided with a cartridge access device such as a robotic picker or other pick and place device for accessing one or

more of the various data cartridges contained in the cartridge receiving devices and a positioning device for moving the cartridge access device among the cartridge rows, and/or into position adjacent the read/write device.

[0003] These cartridge-type data storage systems may be disposed in various alternative arrangements. Single plane systems are available as substantially self-contained units capable of residing on a table-top, or other like location. Such single plane table-top systems may then in some alternative embodiments be adapted to be modified to be dual horizontal plane systems (or even triple plane, quadruple plane or any other reasonable number of planes) by stacking one or more such units upon each other as described generally above. Such systems may then be cooperatively connected together in such a stack or stacks and may be adapted to be structurally secured each to another one or more such systems. It is noted that such modifications may be consumer or factory made and may be temporary or permanent, i.e., special permanent housings for dual, triple, etc. units may be pre-fabricated to create secure, permanent multi-plane systems.

[0004] As an alternative, upright cabinets containing one or more shelves, brackets or racks for supporting one or more single (or dual or triple, etc.) plane systems may be provided to create what may be referred to as a rack mount system. In such a system, the otherwise separately definable units or systems may then be "stacked" vertically one above another, but supported in such an arrangement by the rack frame defined in and/or supported by the cabinet. Pass-through robotics or other, pick and place mechanisms may then operate here as well, without however, the relative planar units having to be secured one to another.

SUMMARY

[0005] Herein disclosed are structures, systems and/or methods which may include a data apparatus comprising: an open-backed housing having a front wall, and first and second side walls; and an open-backed portion defined between the first and second side walls; whereby the open-backed portion is disposed to interchangeably receive any of a plurality of discrete, similarly-sized modules therein.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0006] In the drawings:

[0007] FIG. 1 is an isometric view of a single plane data apparatus;

[0008] FIG. 2 is a front perspective view of a rack mount and/or multiple stack data apparatus;

[0009] FIG. 3 is an isometric, partially cut-away view of a single plane data apparatus as in FIG. 1 being mounted in a rack mount data apparatus like that in FIG. 2;

[0010] FIG. 4 is an isometric, partially exploded view of a multiply stacked data apparatus including two single plane apparatuses like that in FIG. 1;

[0011] FIG. 5 is a rear isometric, partially cut-away view of a single plane apparatus like those in FIGs. 1 3, and 4;

[0012] FIG. 6 is a plan view of a single (or plural) plane apparatus showing an alternative cartridge access system;

[0013] FIG. 7 is a plan view of an alternative single (or plural) plane apparatus showing a further alternative cartridge access system;

[0014] FIG. 8 is an isometric view of an alternative single plane apparatus according to an exemplary embodiment of the present invention;

[0015] FIG. 9 is an isometric view of an alternative single plane apparatus like that in FIG. 8;

[0016] FIG. 10 is an isometric view of an alternative single plane apparatus like those in FIGs. 8 and 9; and

[0017] FIG. 11 is an isometric view of an alternative single plane apparatus like those in FIGs. 8, 9 and 10.

DETAILED DESCRIPTION

[0018] Disclosed herein are modular apparatuses, systems and/or methods directed generally to provision of a housing and one or more interchangeable components or modules adapted to be used therewith. The interchangeable components or modules are insertable in and/or removable from the housing. For further detail, reference will now be made to the following description together with the attached illustrations in the drawings with like numerals indicating like parts throughout the several views.

[0019] Exemplary embodiments of the present invention may be useful in various manifestations including that of a data system **10**, which according to a first such exemplary embodiment as is shown in FIG. 1, may include an apparatus **15**. Apparatus **15** may be, as shown, a substantially single planar, horizontally-disposed apparatus, and may be adapted for data storage and/or retrieval. A single planar or single plane apparatus **15** is, in contrast to a multiple or multi-planar apparatus **55** (see below), one in which data storage cartridges are stored, retrieved and otherwise handled (e.g., written to or read from) substantially on a single plane. Such an apparatus **15** may be a substantially self-contained table-top device or may alternatively be adapted to be disposed in a stack or rack mount data system **50** such as that shown in FIG. 2. Such an apparatus **15** might be disposed on or otherwise connected to one or more rails **52** or the like which are in turn connected to one or more frame members **53, 54** or the like within an overall system **50** as shown for example in FIG. 3.

[0020] Alternatively, two or more such apparatuses **15** may be stacked together to create a stack **55**, also known and referred to as a multiple plane or multi-planar apparatus **55**, as shown in the detailed exemplary embodiment of FIG. 4, where a bottom apparatus **15a** has a top apparatus **15b** stacked thereupon. The stack embodiment **55** in FIG. 4 also shows in more detail some alternative features such as a cartridge handling system **12** for transferring data cartridges **14** (only one shown in FIG. 4) between one or more cartridge receiving devices, such as one or more cartridge storage racks or magazines **16** and one or more cartridge read/write devices **18** (a rear view of the two separate drive units **18a** and **18b** are

shown inserted in an apparatus **15** in FIG. 5). In a multi-plane system **50**, which may include one or more apparatuses **15** as shown in FIGs. 1-3, or one or more multi-plane apparatuses **55** such as is shown in FIG. 4, a vertical lift assembly may be a part of the cartridge handling system **12**, and as such may be a pre-existent part thereof, or a part adapted to be added to the overall multi-plane system upon the creation thereof by the stacking of two or more priorly separate single plane apparatuses **15**. The various cartridge receiving devices (e.g., the cartridge storage racks or magazines **16** and the cartridge read/write devices **18**) may be positioned at various locations around the cartridge handling system **12** so that they define the generally U-shaped configuration shown in FIGs. 6 and 7 (and see FIGs 8-11 described further below).

[0021] Various embodiments of a cartridge handling system **12** are shown in FIGs. 4 and 6 each of which generally includes a frame assembly **26** on which may be supported a mechanical gripper or "picker" **30** of a robotic or other pick and place mechanism. The frame assembly **26** as well as or in cooperative relationship with the open cartridge receiving and delivery sides of the cartridge receiving devices (magazines **16** and/or drive(s) **18**) may define a first cartridge access side **20**, a second cartridge access side **22**, and a third cartridge access side **24** all laying in a horizontal disposition relative to each other. The first and third cartridge access sides **20** and **24** may be positioned in generally spaced-apart relation, whereas the second cartridge access side **22** may be oriented generally transverse to the first and third cartridge access sides **20** and **24**. The various cartridge receiving devices may thus be positioned around the cartridge handling system **12** so that the cartridge receiving devices and the three defined cartridge access sides **20**, **22**, and **24** thereby define a substantial horseshoe or U-shape **40** as depicted by the arrows **40** in FIGs. 6 and 7.

[0022] Referring now to FIGs. 8 – 11, an exemplary apparatus **15** of an exemplary system **10** is shown which includes an open-backed housing **11** with at least a front wall **41**, and right and left side walls **42**, **43** which define an open rear area **46** therebetween (see particularly FIG. 8). The apparatus **15** shown in FIGs. 8 – 11 includes the magazines **16**, with one or more data cartridges **14** (three shown in FIGs. 8 – 10 and four shown in FIG. 11). The front wall **41** may also include magazine doors **44**, **45** with associated magazine door locks, magazine door solenoids, magazine door sensing apparatus, and the like for the insertion and/or removal of magazines **16** in/from the housing **11**. Other elements may also be included on/in the front wall **41** such as any front cosmetics and/or a front control panel **48**

(if desired/required) and other optional components disposed therein and/or attached thereto. Top and bottom walls or plates may also be included particularly for the single plane apparatuses; however, in adapting such single plane apparatuses for stacking or rack mounting the tops and/or bottoms will be removable and removed to open the interior space therebetween to allow for pass-through communication of the robotics or other pick and place machinery for movement of cartridges from one plane to another.

[0023] As introduced, the rear area **46** of the apparatus **15** of FIGs. 8 – 11 is open. The opening **46** provides for receiving interchangeable modules hereafter generally designated with the reference numeral **60** with or without an alphabetical suffix (**a, b, c**, etc.). In at least one embodiment, the modules **60** may desirably have at least one common dimension as will be shown and described further below. A first such module **60** adapted to be disposed in the opening **46** is a base alignment panel **60a** which can be disposed in the opening **46** and optionally attached to each of the side walls **42, 43** to strengthen the entire housing **11** and/or the overall structure or system **10** for shipment/transport purposes and/or to maintain the physical position of housing **11** for stacking and/or rack mounting. The width of the alignment module **60a** fits the width of the opening defined by the walls **42, 43**. Thus, for example, the alignment panel **60a** can be used to hold the respective back ends **62, 63** of the respective side walls **42, 43** in alignment for mounting in a rack, such that the rack-mounting brackets or like features **64, 65** (see FIGs. 8 and 9) are properly aligned. Alternative structural features may be used for alternative rack styles and/or for securing two or more such apparatuses **15** in a stack (see e.g., stack **55** FIG. 4). When an apparatus **15** is completely attached to the rack column structure (see e.g., frame **50** of FIG. 3) or to the stack **55** (see e.g., FIG. 4), the base alignment panel **60a** may be removed from the apparatus **15**. The alignment of the apparatus **15** may now be secured or preserved by the rack/frame **50** or the stack **55**.

[0024] Alternative discrete modules **60** can be interchangeably inserted into this open-backed area **46** of housing **11**. Examples include a cartridge drive module **60b** (with one or more cartridge drives **18**; see FIG. 10) or a cartridge magazine module **60c** (with one or more magazines **61**; see FIG. 11). Each of the alternative discrete modules are functional insert units whether for example, holding the side walls in alignment (e.g., module **60a**), or providing data cartridge read/write capability (e.g., data and/or tape cartridge drive module **60b**), or providing cartridge storage (e.g., cartridge magazine module **60c**). In each of the

examples shown and described here, a shared dimension of width is found in each of modules **60a**, **60b** and **60c**. In this way, each of the modules **60** fits the open-back space defined by the side walls **42**, **43**. Other dimensions may also be shared, as for example the relative heights, which are as shown here, all modules **60** being of the same heights as the side walls **42**, **43**. Such concepts may aid in other aspects of interconnection of the module(s) with the housing **11**, as for example providing additional structural support and/or connection points for unshown top and/or bottom floor and/or ceiling members or plates. Further, one or more of the modules **60** may also share a third dimension, depth; however, as shown here, this added dimension may not be necessary. Module **60a** is shown not as deep or thick as modules **60b**, or **60c**. However, these last two modules, modules **60b**, or **60c**, are shown having substantially the same depth which may provide an additional feature in that either may then present a substantially constant cartridge interface position for interface with the cartridge access device **12**. Such shared configuration sizing may also be described as the modules having or presenting substantially the same spatial depth or volume.

[0025] Each of the modules **60** shown and described here is also optional, not being necessary in any one nor in all embodiments of the invention. There are optional additional module possibilities as well, as for example providing additional or alternative robotics or other pick and place mechanisms, inter alia.

[0026] These alternative modules **60** allow for configuring the overall system **10** to then meet specific customer desires and/or requirements (i.e., what are their application needs and/or desires). The configuration and re-configuration possibilities may then be flexible for one or more single plane apparatuses, as for example allowing for interchangeable modules **60b** having differing numbers of drive devices built therein. Or, as with the stackable or rack mounted alternative architectures (see FIGs. 2-4), pluralities of simply modifiable base apparatuses **10** can be stacked vertically in a stack **55** or rack **50** making larger capacity overall systems **55/50**. As an example where two (or more) discrete apparatuses **15** may be desired to be stacked or put together in a rack, it may be determined that only a single drive device **60b** may be desired for the overall stack/rack **55/50** and thus a substitution of an enlarged capacity magazine module **60c** may be desired to be inserted into one or more of the apparatuses **15** in the resultant stack/rack **55/50**. Thus, an apparatus **15** as from FIG. 10 may be combined with an apparatus **15** as from FIG. 11 in a stack or a rack to form a system having larger cartridge storage capacity than priorly available. Note, this concept may

provide for building cost effective solutions by adding more tape cartridges (e.g. storage locations) or tape drives.

[0027] Components (e.g., modules **60**) of systems **10** (or **50**) may be desirably interchanged for a number of reasons. Some examples of these reasons include not only the customer-specific configurations described above, but also system upgrades or requirements changes, component repair, maintenance, inter alia. More particularly, not only may the customer be able to configure the product system **10** and/or **50** to meet specific requirements/desires; e.g., selecting more drives or alternatively more tape cartridge storage locations; but also, the configuration can be modified, e.g., upgraded at a location of product usage (i.e., in the field), or otherwise, if the customer requirements change at a later date. Tape cartridges (or the magazines or drives associated therewith) may also change over time; for example, they may become less expensive, or they may become less complex and/or improve in product reliability. Then, a data management system **10** as described herein allows for interchanging modules **60** to take advantage of such changes, providing for replacing pre-existent one or more modules with the newer more improved modules **60**. A system **10** such as this may thus be referred to as a modularized system **10**, and a system such as this may also provide for less field installation time and/or may be less prone to field assembly error as compared to potential four sided systems/models (e.g., systems which having front, rear, left and right sides). Thus, systems and apparatuses whether of table-top units, stack and/or rack mounted, may provide for optimized configurability and/or installation and/or repair and/or maintenance.

[0028] It may be noted also that tape drives generally require a power supply, motherboard, and alignment means all of which add cost and complexity. Tape cartridges do not require external power or a motherboard which reduces cost. Separating these two different requirements into modules reduces cost for the customer and allows greater product flexibility. In either case, the power supply, mother board, controller board, fibre board, or the like, would be available in the tape drive module **60b** (see FIG. 10), whereas though possible, the magazine module **60c** which includes additional tape cartridge magazine storage locations, may, but need not include power supply, computing capacity and the like.

[0029] The drive module **60b** and/or drive(s) **18** may be provided with various electro-mechanical sub-systems for reading and writing data from and/or to the media on/in

the data cartridge(s) **14**. In use, a system controller as for example a host computer **56** and/or a network connection **57** (FIG. 2), as from the control panel **48** on one or more of the base apparatuses **15** (see e.g., FIGs. 1 and 8 – 11), or the control panel **58** on the rack system **50** (see FIG. 2) may be used to input a command to retrieve a cartridge **14** in the system **10/50** to ultimately read and/or write data therefrom/thereto. The command will then cause the access device **12** to move to and retrieve the desired cartridge or otherwise have the particular cartridge moved thereto, and then move this cartridge to the tape drive unit **18** to read/write the data as desired. Then, after the desired operation has been completed, the access device can then access the cartridge from the tape drive and then move the cartridge or have the cartridge moved back to the appropriate magazine storage location. Such movements may be all single planar particularly in a single plane data storage/retrieval system or may involve movements in multiple planes, as for example retrieving a cartridge from a particular row of a particular magazine in a first plane, and then moving that cartridge to a second or any other plane for delivery to an appropriate tape drive.

[0030] In some alternative embodiments, the entire back side **46** may not necessarily be entirely open, but rather may have a pre-defined opening size between the back sides **62, 63** wherein the features hereof would remain to be the provision of a plurality of interchangeable modules **60** which would each of which fit within the pre-defined opening of whatever size between those back sides **62, 63** of housing **11**. Thus, there may exist some semblance of a back wall; however, with an opening therein to accommodate the modules **60**. There may further be structure/apparatus defined in and/or attached to the interior portion of the side walls adjacent or at the back sides **62, 63** thereof to accommodate the connection/attachment of the various modules **60** thereinto. The modules **60** would then be adapted to fit in the opening, generally by being of the same size, or substantially similarly-sized. In some embodiments, whether of a completely or only partially open-backed housing/system, such a concept may be referred to as a system providing a standard opening or a standardly-sized opening fitting each and/or all of the modules to be disposed therein, and in some of these embodiments, the standard opening may be of a single size, or "one size fits all"; and thus the modules may be of a standard size.

[0031] The foregoing description has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise embodiments disclosed. Obvious modifications or variations are possible in light of the

above teachings. The embodiment or embodiments discussed, however, were chosen and described to provide illustration of the exemplary principles of the invention and its practical application to thereby enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth to which they are fairly and legally entitled.